THE BIOLOGICAL CYCLE AND POLYMORPHISM OF *BEROSUS AFFINIS* (COLEOPTERA: HYDROPHILIDAE) IN MOROCCO[1]

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ABSTRACT: *Berosus affinis* is univoltine in temporary ponds and bivoltine in fresh or brackish permanent waters. The pigmentation of the pronotum varies with the seasons: the black spot of type "f" is characteristic of the summer generation observed in permanent waters only; the type "e" spot is seen in winter in all specimens of all temporary and permanent aquatic habitats. These findings raise questions about the validity of previously described geographical races.

From 1982 to 1984, I studied the Hydrophiloidea of stagnant waters from the Moroccan Atlantic coast (Aouad, 1984). Among the 27 species collected, *Berosus affinis* Brulle seemed particularly interesting because of its ecological characteristics as well as its polymorphism. I determined its biological cycle with the purpose of finding the origin of polymorphism.

Biological Cycle

Berosus affinis has a biological cycle that depends on whether it has a permanent or a temporary environment. In a temporary habitat, the evolution of the adult population shows only one maximum, when the habitat is refilled with rainwater (Fig. 1 A). The larvae appear in spring; the pupal stage and the burying of the adults coincide with the drought period of the habitat (Fig. 1 B). *Berosus affinis,* at its imaginal stage, burrows in soil to escape summer drought; at this place, it digs a chamber in which it remains quiescent until its habitat is flooded again at the return of the rainy season.

In a permanent environment, from the viewpoint of the number of imagos, *B. affinis* presents two maxima: one in winter with an equal sex-ratio and the other in summer with a slight majority of females (60%) (Fig. 2 A).

After the winter maximum, as soon as the number of adults diminshes, that of the larvae increases until April-May. At the approach of the estival period, pupation takes place in humid soil above water level and lasts nearly a month. In August-September, the summer maximum of imagos occurs. (Fig. 2 B).

[1]Received June 19, 1987. Accepted October 23, 1987.

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Morphological Characteristics and Polymorphism

In 1982, I noted that *Berosus affinis* has, on its pronotum, a dark spot, the form of which varied according to individuals and following the periods of the seasonal cycle. Further, Chiesa (1959) mentioned five varieties of *B. affinis* described by different authors according to the spot on the pronotum (Fig. 3 A-E). The naming of certain of these "varieties" (*hispanicus* Kuster, *algericus* Kuwert) and the interpretation given by Chiesa led me to think that the question of possible "geographical races" needed to be investigated. With the idea of probing previous observations and in order to determine the factors that influence this pigmentation, I followed the evolution of this spot throughout the annual cycle.

The results obtained allowed me to find five other "varieties" (Fig. 3 F-J) in Morocco, different from those described by Chiesa. Also I was able to eliminate some factors that can influence this coloration, such as sexual dimorphism, water temperature, salinity, and the height and age of the individuals. Moreover, during the study of the spot's evolution, I noticed that this is almost the same in all individuals from temporary fresh water ponds and presents variations for those from permanent swamps with fresh or briny water. However, among all the forms encountered, only two appear regularly and frequently: in ponds, only the form "e" is found and in permanent waters, depending on the periods of the year, we detected mostly the form "e", the form "f" or both. If we refer to the biological cycle of *B. affinis,* the winter maximum corresponds to the winter generation, with the individuals having one dark spot in the middle of the pronotum (form "e"), while the summer maximum corresponds to the summer generation, with individuals with two spots in the middle of the pronotum (form "f"). The two other forms of coloration referred to by Chiesa or described by me appear as intermediate stages; they are simple variants of the two most constant and frequent forms. In addition, factors like salinity, nature of substrate, temperature, sunshine and period of filling with water, taken separately, do not seem to have any influence on the coloration but form a combination of conditions that cause variations of the pigmentation around two fundamental varieties, form "e" and form "f".

CONCLUSION

It would seem, then, that *Berosus affinis* in Morocco belongs to a geographical subspecies of which it is not actually possible to specify the limits of the variations of pigmentation. In the present state of our knowledge, we consider *B. affinis* (winter generation) living in the Rabat region, either in ponds or in permanent waters, belonging primarily to form

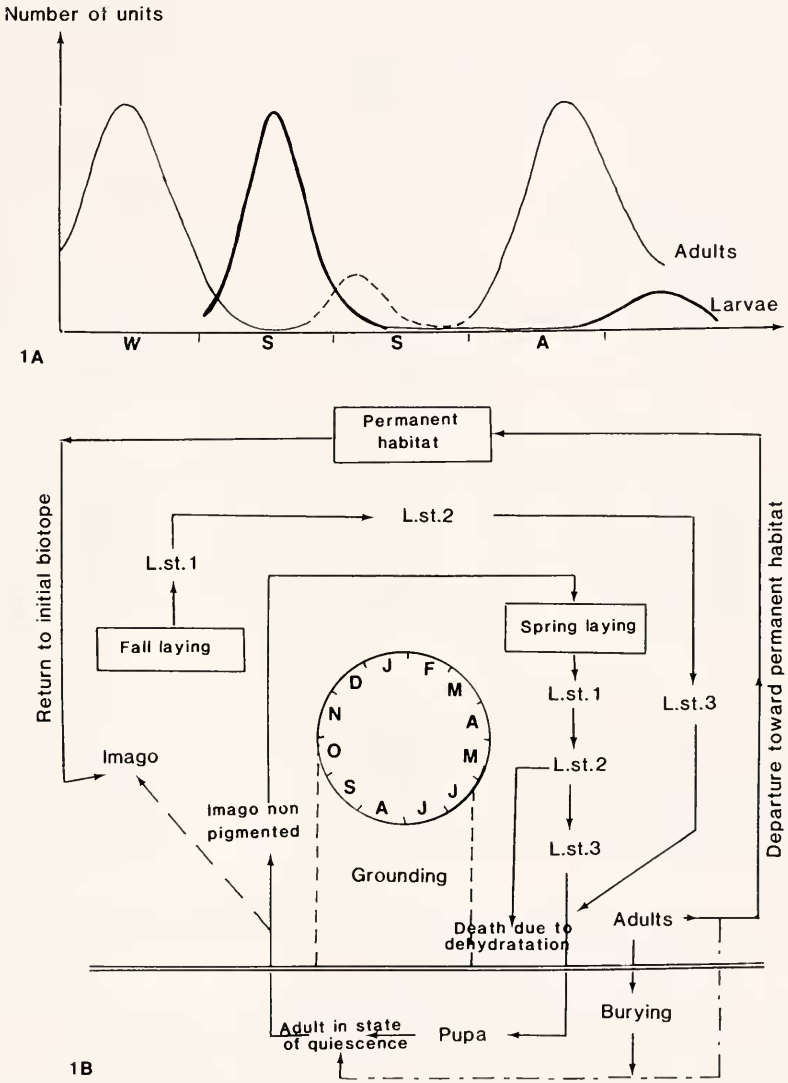
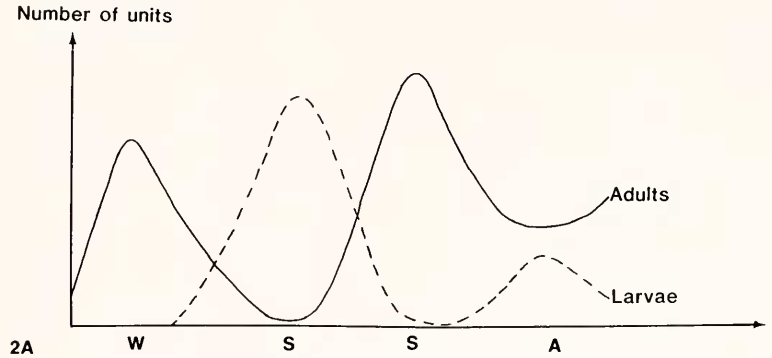


Fig. 1 (A) - Evolution of the number of specimens (adults & larvae) in a temporary pond. W = winter, S = spring, S = summer, A = autumn.

(B) - Development cycle of *Berosus affinis* in a temporary pond.



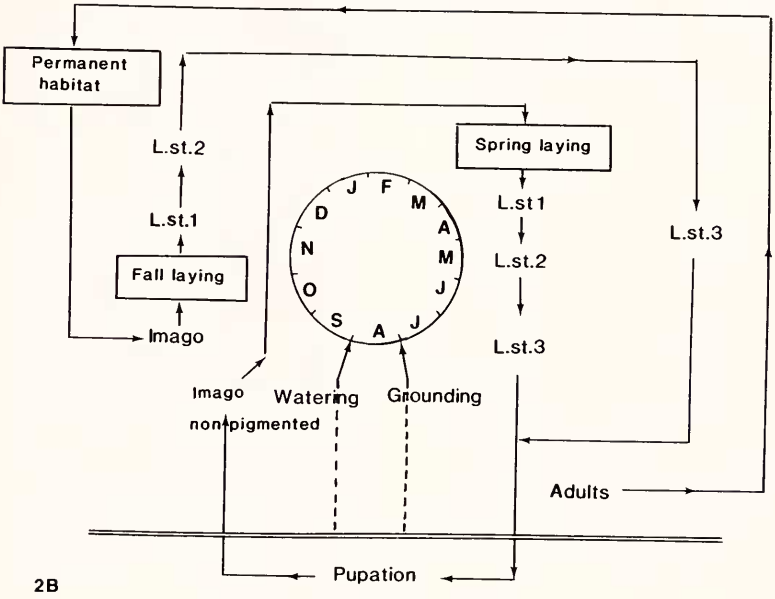


Fig. 2 (A) - Evolution of the number of specimens (adult & larvae) in a permanent stream. W = winter, S = spring, S = summer, A = autumn.

(B) - Development cycle of *Berosus affinis* in a permanent stream.

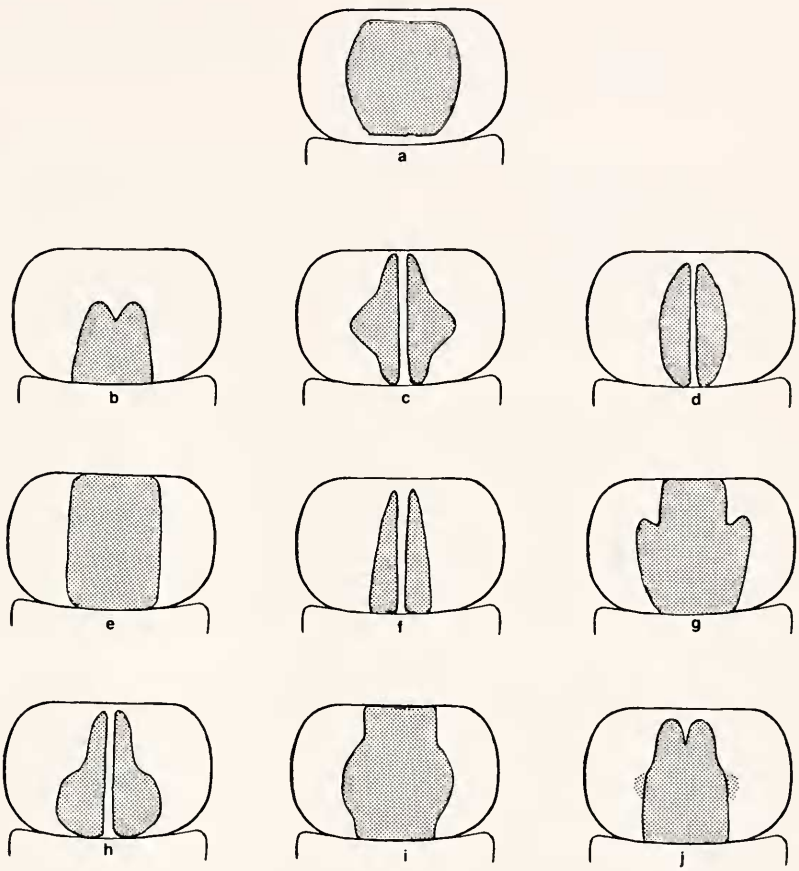


Fig. 3 (a) - *Berosus affinis* Brullé, typical shape. b) *B. affinis suturalis* Kuster. c) *B. affinis hispanicus* Küster. d) *B. affinis lineicollis* Costa. e) *B. affinis algericus* Kuwert. (f-j) Five other forms of *Berosus affinis*.

"e": denominated *B. affinis algericus* by Kuwert. However, the *B. affinis* (summer generation) corresponds to form "f", described by Küster under the name *B. affinis hispanicus*. Thus, these two subspecies could be in reality only seasonal forms of a single species with a large distribution in the Mediterranean region. Moreover, some examples collected in the Camargue region of France in November 1984 include individuals with form "e" and form "f" combined, exactly as they were at the same date in Rabat region

when individuals from the two generations are mixed. When we have collected enough western specimens from different regions and variable seasons, we hope to be able, in the future, to specify and clarify the exact status of *Berosus affinis* from the western basin.

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